U. S. DEPARTMENT OF COMMERCE
JESSE H. JONES, Secretary
NATIONAL BUREAU OF STANDARDS
LYMAN J. BRIGGS, Director

WARM-AIR FURNACES EQUIPPED WITH VAPORIZING POT-TYPE OIL BURNERS

COMMERCIAL STANDARD (EMERGENCY) CS(E)104–43

Effective Date for New Production From January 1, 1943

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OF THE TRADE

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PROMULGATION

of

COMMERCIAL STANDARD (EMERGENCY) CS(E)104–43

for

WARM-AIR FURNACES EQUIPPED WITH VAPORIZING POT-TYPE OIL BURNERS

On June 24, 1942, a conference of representative manufacturers adjusted and adopted a Proposed Commercial Standard for Warm-Air Furnaces Equipped with Vaporizing Pot-Type Oil Burners, which had been in course of development and discussion in a series of meetings beginning on July 14, 1941. The proposed standard was subsequently adjusted to suit composite written comment resulting from a circulation for that purpose on July 10 and 11, 1942, to users, distributors, installers, contractors, manufacturers, and testing laboratories. The adjusted draft was circulated on September 28, 1942 to the entire trade for written acceptance.

Those concerned have since accepted and approved the standard as shown herein for promulgation by the United States Department of Commerce, through the National Bureau of Standards.

The standard is effective for new production from January 1, 1943.

Promulgation recommended.

I. J. Fairchild,
Chief, Division of Trade Standards.

Promulgated.

Lyman J. Briggs,
Director, National Bureau of Standards.

Promulgation approved.

Jesse H. Jones,
Secretary of Commerce.

WARM-AIR FURNACES EQUIPPED WITH VAPORIZING POT-TYPE OIL BURNERS

COMMERCIAL STANDARD (EMERGENCY)[1] CS(E) 104–43

PURPOSE

0.1 This standard is provided as a basis for certification of the quality and performance of warm-air furnaces equipped with vaporizing pot-type oil burners as covered herein, for the guidance of manufacturers, distributors, installers, contractors, and purchasers.

SCOPE

0.2 This standard applies to warm-air furnaces equipped with vaporizing pot-type oil burners and arranged with either gravity or forced-air circulation. It does not include floor furnaces. This standard is composed of the following sections:

DEFINITIONS

0.31 *Warm-air furnace.*—A warm-air furnace is a device for enclosing and directly heating a given amount of air, having provisions for the attachment of pipes or ducts for circulating all of the enclosed heated air to desired locations. It may operate on either the gravity or the forced-air principle.

0.32 *Gravity warm-air furnace.*—A gravity furnace is defined as one which depends primarily upon the difference between the weight of the heated air and the return cold air to produce circulation.

0.33 *Forced-warm-air furnace.*—A forced-air furnace is defined as one which depends upon a power-driven fan or blower to produce circulation of the heated air.

0.4 *Vaporizing pot-type oil burner.*—A device for the combustion of fuel oil, consisting of an oil-vaporizing bowl or other receptacle to which the liquid fuel may be fed in controllable quantities, the heat of combustion being used to vaporize the fuel, with provisions for

[1] It is expected that at the earliest opportunity this standard will be revised so as to permit a single method of test for bonnet capacity and to include other requirements and refinements not practicable at this time.

admitting air and mixing it with the oil vapor in combustible proportions.

0.51 *Standard air* is air weighing 0.075 lb/cu ft. (This weight corresponds to dry air at 70° F or air with 50-percent relative humidity at a dry-bulb temperature of 68° F when the barometric pressure is 29.92 in. mercury.) Specific heat is taken as 0.243.

0.52 *Air delivery* (cfm) is the quantity, in cubic feet of air, passing through the combination per minute, and corrected to standard conditions.

0.6 *Pressure loss* in the connected duct system external to the casing is measured by means of two static-pressure tube connections located at points indicated on figure 1.

The net pressure loss in the duct system will be equal to suction-gage reading, plus discharge gage reading (irrespective of sign), minus the equivalent suction-velocity head. All readings are to be corrected to standard conditions.

0.71 *Entering temperature* (T_1) is the average temperature of the air entering the furnace inlet, measured at the points indicated on figures 1 and 10, expressed in degrees Fahrenheit. If the thermometer (or thermocouple) as located is subject to radiation from heated surfaces, this temperature should be taken as the room temperature within 3 ft of the inlet.

0.72 *Final temperature* (T_2) is the average temperature of the air discharged from the furnace outlet, measured at the points indicated on figures 1 and 10, expressed in degrees Fahrenheit.

0.73 *Flue-gas temperature* (T_3) is the average temperature of the flue gases measured at the point indicated on figure 2, expressed in degrees Fahrenheit.

0.74 *Room temperature* (T_4) is the average temperature of the air surrounding the furnace, taken with a shielded thermometer 3½ ft above the floor and not subject to drafts.

0.81 *Oil input* is the rate at which oil is supplied to the furnace, in gallons per hour.

0.82 *Calorific value* of the oil is the high heating value of the fuel used for the tests, expressed in Btu per pound, as specified in sections 4 and 5, respectively.

0.83 *Heat input* is the total gross heating value of the oil supplied to the furnace, expressed in Btu per hour.

0.90 *Bonnet.*—The warm-air distribution chamber at the outlet of the furnace.

0.91 *Bonnet capacity* is the heat delivered at the bonnet of the furnace, expressed in Btu per hour. This capacity is to be used when the furnace is installed exterior to the space to be heated.

0.92 *Bonnet efficiency* is the percentage of heat input which is delivered at the bonnet of the furnace.

0.93 *Gross output* is the heat, expressed in Btu per hour, available for space heating, including the heat transfer through the casing, plenum chamber, and exposed stack. This output is to be used when the furnace is installed within the space to be heated.

0.94 *Stack loss* is the percentage of the heat value of the fuel escaping, as indicated by the combustion efficiency chart.

0.95 *Gross efficiency* is the percentage of heat input which is available for gross output delivery.

GENERAL REQUIREMENTS

1.1 *Safety.*—The furnace and burner shall meet the safety requirements of the Underwriters' Laboratories, Inc., and the National Board of Fire Underwriters. Presence on the furnace of the label of Underwriters' Laboratories, Inc., shall be accepted as evidence of compliance with these safety requirements for the application for which the equipment is listed.

1.2 *Durability.*—The design and construction of the furnace and burner shall be such as to ensure its durability in service as outlined in section 2.

1.3 *Dependability.*—The furnace and burner shall be capable of functioning uniformly and reliably when installed and adjusted in accordance with the manufacturer's instructions.

1.4 *Noise.*—The furnace and burner shall be reasonably free from disturbing combustion and/or mechanical noises and shall cause no undue amount of radio interference.

1.5 *Furnace testing and rating.*—Each furnace model shall be tested and rated as outlined in sections 4 and 5. The ratings shall be clearly set forth in the manufacturer's catalog or literature and on the furnace name plate as outlined in sections 6 and 7.

1.6 *Efficiency.*—The furnace shall be capable of meeting the minimum efficiency requirements outlined in section 3.

1.7 *Operating instructions.*—Each furnace shall be accompanied by a complete set of instructions covering essential points with respect to selection of fuel, installation, operation, and upkeep.

FURNACE DESIGN AND CONSTRUCTION

2.1 *The outer casing,* or jacket, shall be constructed of steel or other suitable material and of such design that it is not readily damaged or dented in shipment or use.

2.2 *Oil burners* shall be of the vaporizing pot type, constructed of steel, not lighter than 20 gage (see par. 2.7), or other suitable material of equal resistance to heat, corrosion, and fuel leakage.

2.3 *Combustion chambers,* radiating drums and/or other surfaces exposed to the direct heat of the burner flame shall be constructed of sheet steel not lighter than 20 gage, or other suitable material. The temperature of the metal shall not exceed 1,000° F. under conditions of the rating test as specified in sections 4 and 5, unless constructed of heat-resisting material suitable for the temperature encountered. Combustion chambers shall be fitted with doors or equivalent means for permitting access to interior surfaces of the burner and other surfaces as required for lighting, cleaning, servicing, etc.

2.4 *Radiators* or economizers, when used, shall be constructed of not lighter than 20-gage steel, or other suitable material, and the construction shall be such as to ensure strength, rigidity, and durability. The total area of the flue passages shall never be less than that of a 6-in.-diameter pipe.

2.5 *The flue collar* shall be constructed of cast iron, or of sheet steel of suitable thickness, but not less than 20 gage, and shall be rigidly attached at the flue outlet of the furnace. It shall afford convenient suitable means for attaching the flue pipe securely to the flue collar.

2.6 *Finish.*—Outside surfaces of furnace casings, grilles, and accessories shall be adequately protected against rust or corrosion and against damage during manufacture, test, shipment, and reasonable conditions of storage. The casing shall be protected by the use of baffles, inner liner, or insulating material to ensure durability of the finish.

2.7 *Sheet-steel gages.*—All sheet-steel gages specified in this standard shall be interpreted as indicated below:

Manufacturers' standard practice gage numbers	Thickness (in.)
18	0.0478 plus or minus mill tolerance.
20	.0359 plus or minus mill tolerance.
22	.0299 plus or minus mill tolerance.
24	.0239 plus or minus mill tolerance.
26	.0179 plus or minus mill tolerance.
28	.0149 plus or minus mill tolerance.

2.8 *Furnace accessories and fittings.*

2.81 *The means for oil control* shall be of substantial construction of corrosion-resistant parts, with provisions for rigid attachment to the furnace, or it may be furnished integral with a constant-level value. The control valve or other means for oil control shall be accessible for operation and servicing and shall have means for controlling the desired oil flow and restricting the maximum setting.

2.82 *The constant-level valve* shall be of the manual reset, float-and-trip type permitting air escapement, or otherwise be so constructed as to prevent excessive accumulations of oil in the valve. It shall have provisions for rigid mounting on the furnace and be supported independently of the piping. All parts shall be made of corrosion-resistant material.

2.83 *An automatic draft regulator*, meeting the requirements of the Underwriters' Laboratories, Inc., shall be furnished with each oil furnace. It may be furnished integral with the furnace, or with instructions for its installation.

2.84 *Gaskets*, where required for fuel-handling parts, shall be of soft copper, copper-asbestos, hard lead, or approved equivalent for screwed joints, and of Underwriters' Laboratories, Inc., listed sheet packing or its equivalent for bolted joints.

2.85 *Electric equipment.*—All electric parts, including electric controls and electric motors, shall meet the safety requirements of the Underwriters' Laboratories, Inc., for such equipment. Burner and fan motors of one-eighth horsepower and over shall be of the general-purpose type and commercially accepted as being free from objectionable radio interference. The maximum load on motor under conditions of maximum rating test shall not exceed its name-plate rating, except that general purpose motors with a service factor as defined by NEMA [2] standards shall be considered as meeting the above requirement when provided with suitable *overtemperature* protection. Means shall be provided for the prevention of static accumulations.

2.86 *Air filters* when used must be so located that no point on the filter will reach a temperature in excess of 90°F above room temperature when the furnace is being operated at maximum output with the

[2] National Electrical Manufacturers Association.

forced-air equipment either operating or not operating. Average velocity through filters shall not exceed 300 fpm. Filter area shall be based on nominal external dimensions.

PERFORMANCE

3.0 The furnace shall be capable of meeting the following minimum performance requirements, when tested as outlined in sections 4 and 5.

3.1 *Lighting and warming up burner.*—Adequate provision shall be made to insure ease of lighting, and to insure against extinguishment of the burner flame after lighting and before the burner has become thoroughly heated.

3.2 *Operating of burner and controls.*

3.21 Controls shall reliably perform the respective functions for which they are intended.

3.22 The burner shall be capable of functioning uniformly and reliably without excessive carbonization or other phenomena that would impair its safe and proper operation on the grades of fuel recommended by the manufacturer for use therein.

3.3 *Heating capacity.*

3.31 The furnace shall be capable of delivering heat as rated by the manufacturer when tested as outlined in sections 4 and 5.

3.4 *Air delivery.*

3.41 The blower in a forced-air furnace shall be capable of delivering the full rated output of the furnace with an air-temperature rise of 90° F (plus or minus 10° F) when tested as outlined in section 4 against a static pressure in the connected duct system, external to the casing, as shown in section 4.

3.5 *Operating efficiency.*

3.51 When tested at manufacturer's recommended draft and at full rated output as outlined in sections 4 and 5, furnaces shall be capable of operating at the following efficiencies:

(a) 72-percent gross efficiency on forced-air furnaces equipped with natural- or mechanical-draft burners.

(b) 70-percent gross efficiency on gravity furnaces equipped with either natural- or mechanical-draft burners.

TEST CODE FOR FORCED-AIR FURNACES

4.1 The Btu input, output, efficiency, and cfm air delivery shall be determined in accordance with the following method or its equivalent as approved by the standing committee:

4.2 *Arrangement of testing apparatus for forced-air furnace.*

4.21 The furnace and filter, if provided for in furnace construction, shall be installed in accordance with the manufacturer's instructions. The furnace shall be provided with inlet and outlet ducts, as shown in figure 1. Connections shall be provided for measuring the static pressure at the points at which the outlet duct is connected to the furnace, and thermometers or suitable means shall be used in the duct to obtain the average temperature of the inlet and outlet air. Humidifiers, if provided, shall be in place but left dry. The furnace shall be connected to a source of draft. The instruments for weighing the fuel used, testing draft and static pressure, measuring stack temperature and temperatures of inlet and outlet air, sampling flue gas,

and checking smoke shall be installed as shown in figures 1 to 6, inclusive.

4.22 There shall be no check-draft damper between the furnace and the point where the flue-gas sample is taken or the flue-gas temperature measured; if one is incorporated in the furnace, it shall be thoroughly sealed during all tests.

4.23 *Source of draft.*—The draft may be produced by a chimney, or by a fan or other arrangement for providing induced draft.

4.24 *Soot and dust.*—The heating surfaces, furnace, flues, and chimney shall be clean and free from soot and dust at the beginning of the test.

4.3 *Instruments and measuring apparatus.*

4.31 Weighing scales for determining fuel consumption, draft gages, pressure gages, barometer, thermometers, pyrometer with ICHAM [3] standard thermocouple for measuring stack temperature, ICHAM smoke meter and orsat gas analyzer of suitable accuracy shall be provided and installed as outlined in paragraph 4.21 above.

4.32 *Weighing scales.*—Scales accurate to 0.01 lb shall be provided for weighing fuel oil.

4.33 *Draft gages.*—Measurements shall be made with gages reading to 0.01 in. of water. Gages shall be checked for zero reading at the beginning and the end of each test. A draft gage with an accuracy of plus or minus 0.0025 in. water column shall be used.

4.34 *Pressure gage.*—An inclined draft gage shall be provided and arranged as shown in figure 1 to determine the pressure loss in the connected duct system external to the casing. Measurements shall be made with a gage reading to 0.01 in. of water. A draft gage with an accuracy of plus or minus 0.0025 in. shall be used. The static pressure connections shall consist of a ¼-in. diam nipple soldered to the surface of the duct and centered over a hole 0.040 in. in diameter drilled through the sheet-metal duct. The inner surface of the duct shall be free from burrs and irregularities.

4.35 *Fan measurements.*—A wattmeter shall be placed in the electric circuit of the fan motor to measure the power consumption. A revolution counter, or other equal instrument, shall be provided to measure the speed of the fan.

4.36 *Temperature measurement.*—Accurately calibrated instruments shall be provided for all temperature measurements. Mercury thermometers or thermocouples may be used, the latter being preferable.

4.37 *Flue-gas analysis.*—The flue-gas sample for analysis shall be taken as indicated in figures 2 and 3.

A three pipette orsat or equivalent gas analyzer shall be used.

4.4 *Calorific value of fuel.*

4.41 The API [4] gravity of the fuel shall be determined with a hydrometer according to ASTM [5] specifications and recorded on the test report.

4.42 The fuel used for furnace-rating tests shall be of the heaviest grade recommended by the manufacturer and shall be assumed to have a gross heating value as given in the following table.

[3] Institute of Cooking & Heating Appliance Manufacturers.
[4] American Petroleum Institute.
[5] American Society For Testing Materials.

Calorific values for fuel oil

Degrees API at 60° F	Density pounds per gallon	Btu per pound	Btu per gallon	Degrees API at 60° F	Density pounds per gallon	Btu per pound	Btu per gallon
30	7.305	19,420	141,800	38	6.960	19,680	137,000
31	7.260	19,450	141,200	39	6.920	19,720	136,400
32	7.215	19,490	140,600	40	6.879	19,750	135,800
33	7.171	19,520	140,000	41	6.839	19,780	135,200
34	7.128	19,560	139,400	42	6.799	19,810	134,700
35	7.085	19,590	138,800	43	6.760	19,830	134,100
36	7.043	19,620	138,200	44	6.722	19,860	133,500
37	7.011	19,650	137,600	45	6.684	19,890	132,900

The above figures are from National Bureau of Standards Miscellaneous Publication M97 (table 6).

4.5 *Test conditions.*

4.51 The tests shall be run under the following specified conditions:

(a) The furnace shall be operated under rated test conditions until equilibrium conditions of air temperatures, fuel-flow rate, and flue-gas temperature have been established.

(b) The average draft during the test shall be that recommended by the manufacturer for high fire operation, but not to exceed 0.06-in. water column for natural draft, not to exceed 0.04 in. for mechanical-draft burners, and not less than 0.02-in. water column for either. The maximum fluctuation in draft during the test shall not exceed plus or minus 0.005 in. water column.

(c) The fuel-feed rate shall be such that the temperature of the outlet air exceeds the temperature of the inlet air by 90° F. (plus or minus 10° F.) but not above the rate at which the amount of smoke in the flue gases reaches the maximum allowable by the ICHAM smoke test (10-percent reading after a 20-min. exposure).

(d) The observed flue-gas temperature at maximum-output rating shall not be less than 300° F. nor more than 880° F. above room temperature for natural-draft burners, nor more than 780° F. above room temperature for mechanical-draft burners, and the percentage of CO_2 in the stack gases shall be not less than 10.

(e) The above tests shall be conducted at the maximum and minimum ratings specified by the manufacturer.

4.52 Unburned fuel gases shall not occur in the flue products in sufficient quantities to exceed the following:

4.521 To be measurable by recognized methods of gas analysis as unburned fuel gas or vapors in excess of 0.2 percent by volume, or

4.522 To result in failure of the observed CO_2 and O_2 values to check at the ultimate by more than 0.5 percent of O_2 on the check chart, figure 7.

4.53 Furnaces shall be tested with a total external static pressure [6] varying according to the rated cfm output reduced to standard density in accordance with the following table:

[6] This is identical with the pressure loss in the connected duct system external to the casing as defined in par. 0.6.

Cfm	External static pressure
	In.
0 to 800	0.12
Over 800 to 1,600	.20
Over 1,600 to 3,000	.24
Over 3,000 to 6,000	.30

4.6 *Observations during test.*—After equilibrium conditions have been established, the actual rating test shall be started and continued for at least 1 hour.

4.61 The observations shall be made and recorded at the start of the test and at three approximately equal intervals throughout the test.

4.62 The absence of visible red spots on the combustion chamber will be accepted as evidence of compliance with the temperature requirements of paragraph 2.3.

4.7 *Corrections for altitude.*

4.71 The appropriate correction factor from the following table may be used for converting the fuel-oil-input rate at the smoke point at higher altitudes to the corresponding fuel-input rate at sea level. (In no case, however, shall the corrected fuel-input rate used for furnace rating purposes exceed the maximum fuel-flow rate obtainable at high fire valve setting with recommended fuels.)

4.72 *Table of altitude correction factors.*—

Approximate altitude [a]	Barometric pressure	Correction factor	Approximate altitude [a]	Barometric pressure	Correction factor
Ft.	*In. mercury*		*Ft.*	*In. mercury*	
0	30.0	1.00	4,000	26.0	1.16
500	29.5	1.02	4,500	25.5	1.18
1,000	29.0	1.04	5,000	25.0	1.20
1,500	28.5	1.06	5,500	24.5	1.22
2,000	28.0	1.08	6,000	24.0	1.24
2,500	27.5	1.10	6,500	23.5	1.26
3,000	27.0	1.12	7,000	23.0	1.28
3,500	26.5	1.14			

[a] The effective furnace-output rating for regions higher than sea level may be estimated by dividing the rated hourly heat output at sea level by the conversion factor corresponding to the higher altitude indicated in the above table. If provisions are made for assuring correct air supply for high-altitude work in accordance with the above table, this correction in output is not required. Such units as are intended for high-altitude work shall be plainly marked adjacent to the manufacturer's rating name plate with the altitude range for which they are designed.

4.8 *Determination of bonnet capacities.*

4.81 Until such time as the industry adopts a uniform method of measuring bonnet output, bonnet capacities may be determined either by actual test, using the American Society of Refrigerating Engineers Standard Methods of Rating and Testing Self-Contained Air Conditioning Units for Comfort Cooling, ASRE Circular No. 16, or a wind-tunnel method hereinafter approved by the manufacturer representatives on the standing committee, or may be approximated by deducting 5 percent from the gross heat output. When bonnet capacities are specified, the manufacturer shall clearly indicate in his literature the method used.

4.82 *Rated cfm output.*—The cubic-feet-per-minute air delivery under standard conditions may be determined by actual test as specified under paragraph 4.81 or from the following formula, using the setup shown in figure 1.

$$\text{cfm}=\frac{0.95\times\text{Btu}}{0.243\times60\times0.075\times(T_2-T_1)}$$

simplified

$$\text{cfm}=\frac{0.869\times\text{Btu}}{T_2-T_1},$$

Btu = Gross Btu output per hour.
cfm = Cubic feet per minute.
0.243 = Specific heat of air.
60 = Minutes per hour.
0.075 = Weight of 1 cu ft of air at 70° F. at 29.92 in. barometer.
T_1 = Average inlet-air temperature in ° F.
T_2 = Average outlet-air temperature in ° F.

4.83 *Table for correction to standard API gravity at 60° F.*

Observed temperature of oil	Observed gravity, degrees API				
	30	33	36	39	42
° *F.*					
50	30.7	33.7	36.7	39.8	42.8
60	30.0	33.0	36.0	39.0	42.0
70	29.3	32.3	35.3	38.2	41.2
80	28.7	31.6	34.6	37.5	40.4
90	28.0	30.9	33.8	36.7	39.6
100	27.4	30.3	33.2	36.1	38.9

4.84 The Btu input shall be determined by multiplying together the pounds of fuel used per hour and the Btu per pound as obtained from paragraph 4.42, using the gravity corrections specified under paragraph 4.83.

TEST CODE FOR GRAVITY FURNACES

5.1 The Btu input, output, efficiency, and cfm air delivery shall be determined in accordance with the following method:

5.2 *Arrangement of testing apparatus for gravity furnace.*—

5.21 Gravity furnace shall be equipped with a bonnet and with leader pipe collars of conventional type to fit 8-in., 10-in., or 12-in. leader pipe, as selected by the manufacturer. The combined cross-sectional area of the leader pipe in square inches shall not exceed

$$\frac{0.70\times\text{Btu input}}{111}$$

NOTE.—(This formula is based on using an assumed 70 percent efficiency and the figure of 111 is used as the number of Btu carried by 1 sq in. of pipe area.) The combined area of the leader pipe openings shall be as uniformly distributed around the bonnet as possible. If provisions are made for such installation in the field, there may be two return air-duct openings having the same total area as the leader pipes used. The furnace manufacturer shall provide suitable return-air pipes the full size of these return openings and 8 in. long, as shown on figure 10. The furnace shall be set up and provided with test leader pipes, as shown on figure 10. It shall be connected to a source of draft and the instruments for measuring fuel used, testing draft, measuring stack temperature and temperatures of incoming and outgoing air, sampling flue gas, and checking smoke shall be located as shown on figures 1 to 6, inclusive.

Furnaces, equipped with a single floor register directly attached to the plenum providing the principal means for discharge of the heated air, shall be tested with the register in place and be set at an elevation of 7 ft. 6 in. above the base of the furnace. Auxiliary leader pipe openings, if used, shall be fitted with test leader pipes, as shown on figure 10.

5.22 The provisions of paragraphs 4.22, 4.23, and 4.24 shall apply to the testing of gravity furnaces.

5.3 *Instruments and measuring apparatus.*

5.31 The instruments and measuring apparatus used shall be the same as specified in paragraphs 4.31 to 4.37, inclusive, omitting paragraphs 4.34 and 4.35.

5.4 *Calorific value of fuel.*

5.41 The calorific value of the fuel shall be determined as specified in paragraphs 4.41 and 4.42.

5.5 *Test conditions.*

5.51 The tests shall be run under the following specified conditions:

(a) The furnace shall be operated under rated test conditions until equilibrium conditions of air temperatures, fuel flow rate, and flue-gas temperature have been established.

(b) The average draft during the test shall be that recommended by the manufacturer for high fire operation, but not to exceed 0.06 in. water column and not less than 0.02 in. water column. The maximum fluctuation in draft during the test shall not exceed plus or minus 0.005 in. water column.

(c) The fuel feed rate shall be the maximum recommended by the manufacturer but

(1) not above that rate at which the temperature of the air at any outlet exceeds the temperature of the inlet air by 160° F,

(2) not above the rate at which the amount of smoke in the flue gases reached the maximum allowable by ICHAM smoke test (10-percent reading after 20-min exposure).

(d) The temperature of the air at any warm air outlet shall not vary more than 30° F from the average of the discharge temperature observed at all of the warm-air outlets.

(e) The observed flue-gas temperature at maximum-output rating shall be not less than 300° F nor more than 920° F above room temperature, and the percentage of CO_2 in the stack gases shall be not less than 10.

5.52 The provisions of paragraphs 4.52, 4.521, and 4.522 shall apply to this test.

5.6 *Observations during test.*—After equilibrium conditions have been established, the actual rating test shall be started and continued for at least 1 hour.

5.61 The observations shall be made and recorded at the start of the test and at three approximately equal intervals throughout the test. The form of data sheet shown on page 11 is to be used for recording the test data.

5.7 *Corrections for altitude.*

5.71 The correction factors shall be the same as specified in paragraphs 4.71 and 4.72.

STANDARD OIL-FURNACE RATING TEST FOR OBTAINING GROSS OUTPUT

Data and Report Sheet

Manufacturer's Test No._____

Oil furnace _____
Make Model Type or No. Number and size of burners

Fuel used for test _____
Brand API gravity at 60° F.

Date of test _____ Tested by _____

	4 sets of readings at equal intervals 20 minutes apart				Avg
1. Draft (in. water)					
2. Room temperature T_4 (°F)					
3. Smoke-meter readings (%)					
4. Fuel-temperature readings (°F)					
5. Time intervals used for fuel readings					
6. Fuel-input readings (specify units)					
7. Fuel-oil input rate (lb/hr, avg)					
8. Barometric pressure (in. mercury)					
9. Factor to correct fuel input to sea level (par. 4.7)					
10. Fuel-oil input (corrected to sea level) (lb/hr, avg)					
11. Gross heating value of oil [1] (Btu/lb)					
12. Gross heat input (corrected to sea level) (Btu/hr)					
13. Flue-gas temperature (°F)					
14. Flue-gas temperature rise above room temperature (°F)					
15. CO_2 in dry flue gas (%)					
16. O_2 in dry flue gas (%)					
17. Unburned gases expressed as CO (%)					
18. Gross efficiency for complete combustion from chart, figure 8 or 9 (%)					
19. Percentage heat losses due to incomplete combustion (from formula) figure 7 (%)					
20. Gross furnace efficiency equals (item 18 minus item 19) (%)					
21. Gross Btu output equals (item 12 times item 20) (Btu)					
22. Outlet-air temperature, t_2:					
No. 1 thermometer or thermocouple (°F)					
No. 2 thermometer or thermocouple (°F)					
No. 3 thermometer or thermocouple (°F)					
No. 4 thermometer or thermocouple (°F)					
T_2 average (°F)					
23. Inlet-air temperature, t_1:					
No. 1 thermometer or thermocouple (°F)					
No. 2 thermometer or thermocouple (°F)					
T_1 average (°F)					

24. Average temperature rise equals (item 22 minus item 23) (°F) _____
25. Static pressure at bonnet outlet [2] (in.) _____
26. Rated cfm output _____
27. Blower speed [2] (rpm) _____
28. Electrical input to blower motor [2] _____ volts _____ amperes _____ watts
29. Commercial Standard grade of fuel used _____
30. Observed API gravity of fuel _____ at _____ °F
31. API gravity of fuel corrected to 60° F _____

We hereby certify that the above data are true and accurate copies of that obtained when the above heater was tested in accordance with sections 4 and 5 of Commercial Standard for Warm Air Furnaces Equipped With Vaporizing Pot-type Oil Burners, CS104–43.

For _____
Address _____
By _____

_____
Date

[1] For calorific value of fuel from table under 4.42, select closest value for API gravity as obtained for item 31.
[2] Not required for gravity furnaces.

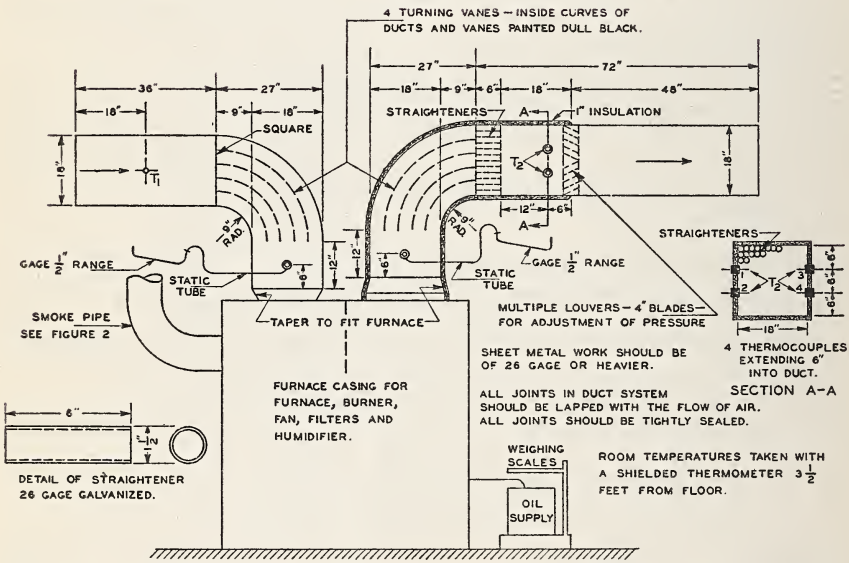


FIGURE 1.—*Schematic diagram showing arrangement of apparatus for testing fan-furnace combination units.*

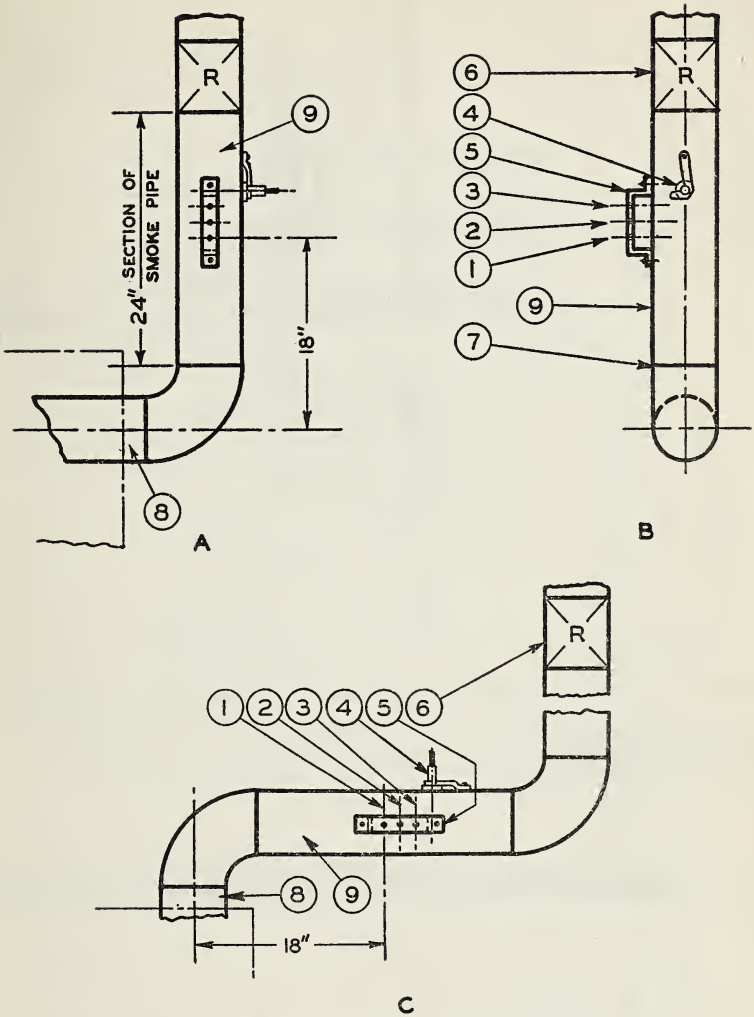


FIGURE 2.—*Furnace flue connections.*

1. Center line of thermocouple, see figures 3 and 4.
2. Gas-sampling tube, see figure 3.
3. Draft tube, see figure 3.
4. 8-mm clear-glass rod and holder, see figure 5.
5. Support bracket, see figure 3.
6. Draft regulator.
7. Seal all openings in stove pipe below gas-sampling tube.
8. Flue collar.
9. Section of smoke pipe, same nominal diameter as furnace flue collar.

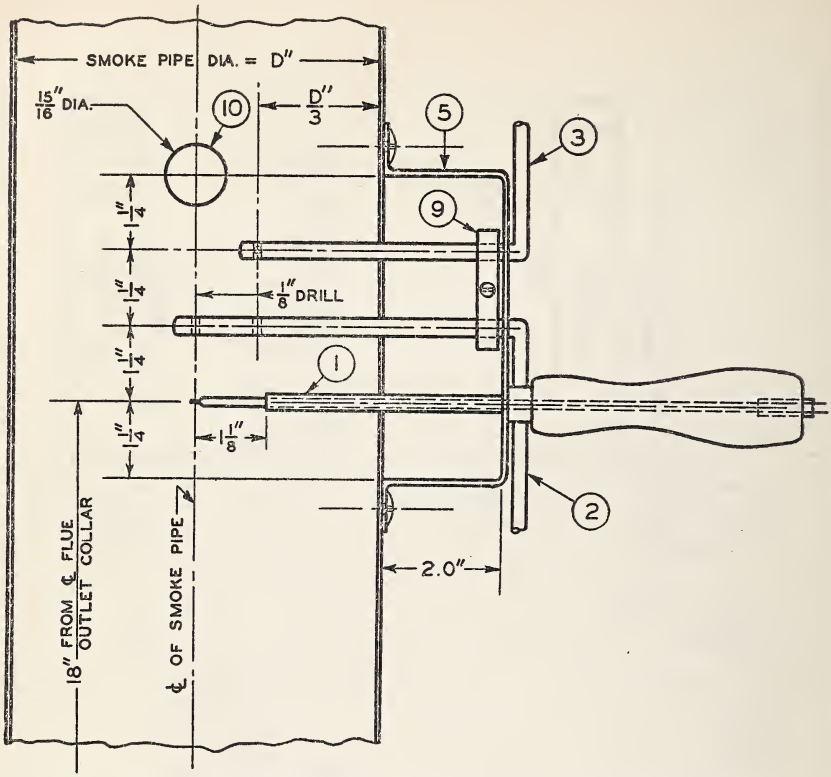
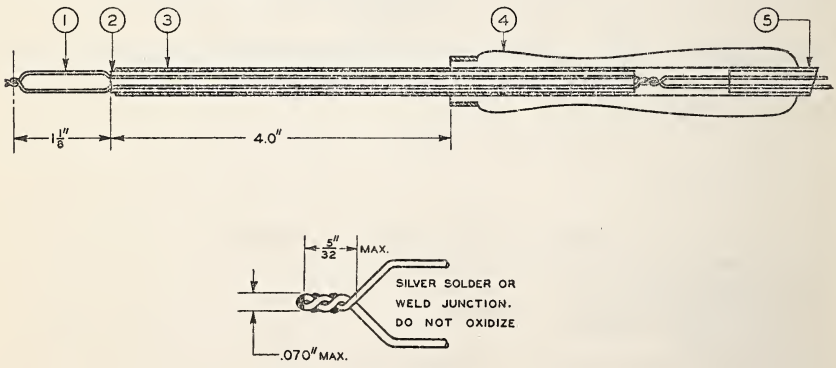


FIGURE 3.—*Gas-sampling and draft tubes, thermocouple and support bracket assembly.*

MATERIALS

1. Thermocouple, see figure 4.
2 and 3. Gas-sampling and draft tubes (¼- by approx. 0.032-inch wall, yellow brass or steel).
5 and 9. Support bracket and tube clamp (½- by 0.093-inch half-hard flat steel wire).
10. Hole in smoke pipe for glass rod.



DETAIL OF HOT JUNCTION

FIGURE 4.—*Standard thermocouple for flue-gas temperature measurement.*

1. 10′—No. 20 B&S gage iron-constantan, asbestos, or woven glass-covered thermocouple wires extending from hot junction to potentiometer or reference junction.
2. 1—Leeds & Northrup standard 714B, or equal, ¼ inch O. D.—2-hole porcelain insulator cut 6.0 in. long and ends beveled on two sides.
3. 1—5/16-inch O. D. by 0.032-inch wall half-hard yellow-brass tubing cut 5⅞ inches long. Ream, if necessary, to fit over insulator; then crimp ends over beveled ends of insulator.
4. 1—Small wooden handle.
5. 1—Piece of rubber tubing, 5/16 by 3/32 by 2 inches long.

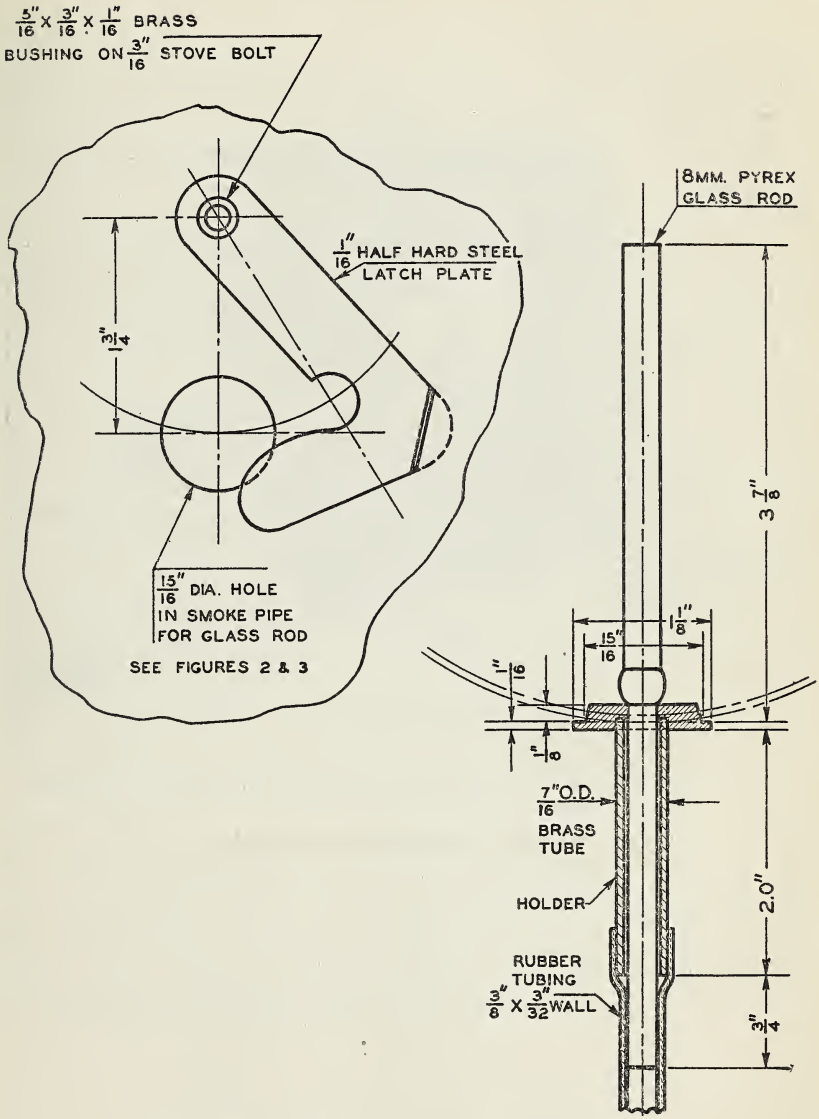


FIGURE 5.—*Glass rod, rod holder, and latch plate.*
Scale: Full size.

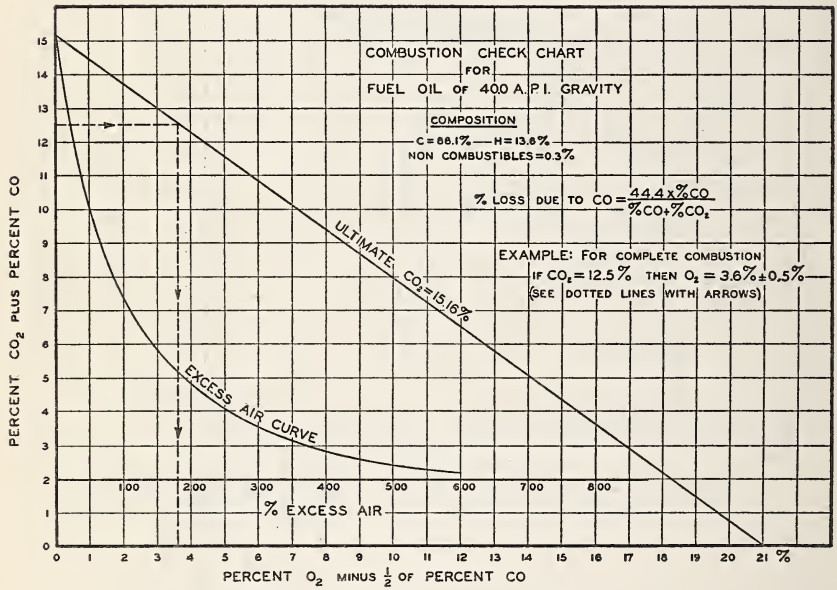


FIGURE 7.—*Combustion check chart.*

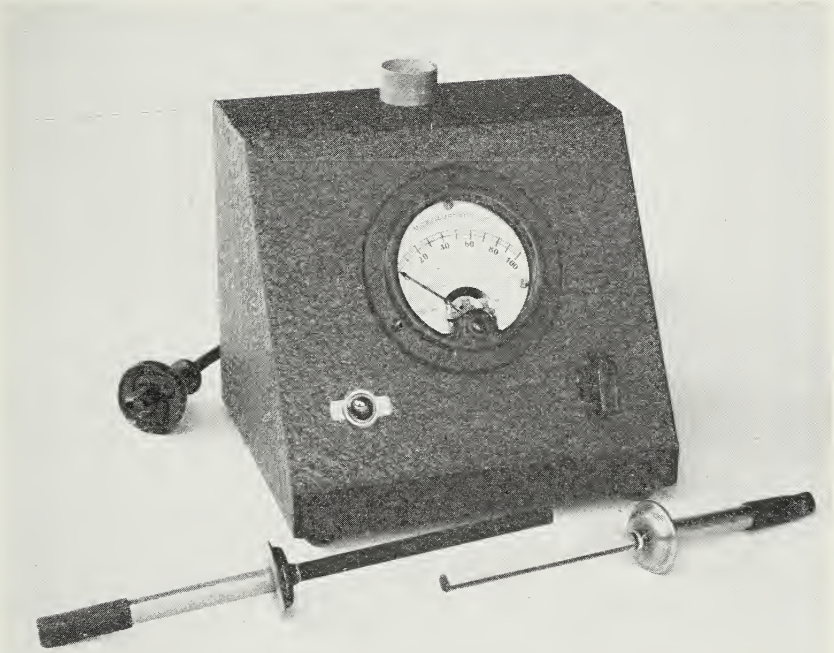


FIGURE 6.—*Institute of Cooking & Heating Appliance Manufacturers smoke meter.*

Principle of Operation.—The smoke meter shown above is better described as a photoelectric soot-density comparator. Its operation and use are based on the principles that:

1. A Pyrex-glass rod placed across a stream of flue gas containing oil smoke will collect a deposit of soot on the surface of the rod.
2. Under specified exposure conditions, the amount or depth of soot deposit on the glass rod will be a function of the smoke density, or the proportion of smoke in the flue products.
3. The depth or amount of this smoke deposit can be measured or evaluated in terms of the extent to which it will interfere with the passage of a beam of light through the glass rod onto a photoelectric cell.

Description.—The meter consists of means for supporting a glass or metal rod and means for passing a beam of light through the glass rod onto a photoelectric cell connected to an electric meter. A constant-voltage transformer should be used if the line voltage fluctuates objectionably. The over-all size of the meter is approximately 5½ by 5½ by 6½ inches. Weight approximately 4 pounds without transformer.

Operation.—The meter is adjusted for a "zero" reading with a dull-black, opaque rod and for a 100 reading with a clean glass rod. The glass rod is then exposed to the smoke in the flue pipe and placed in the meter to give a reduced meter reading (percentage of light transmitted).

For further information regarding the ICHAM smoke meter write to the Institute of Cooking & Heating Appliance Manufacturers, Shoreham Hotel, Washington, D. C.

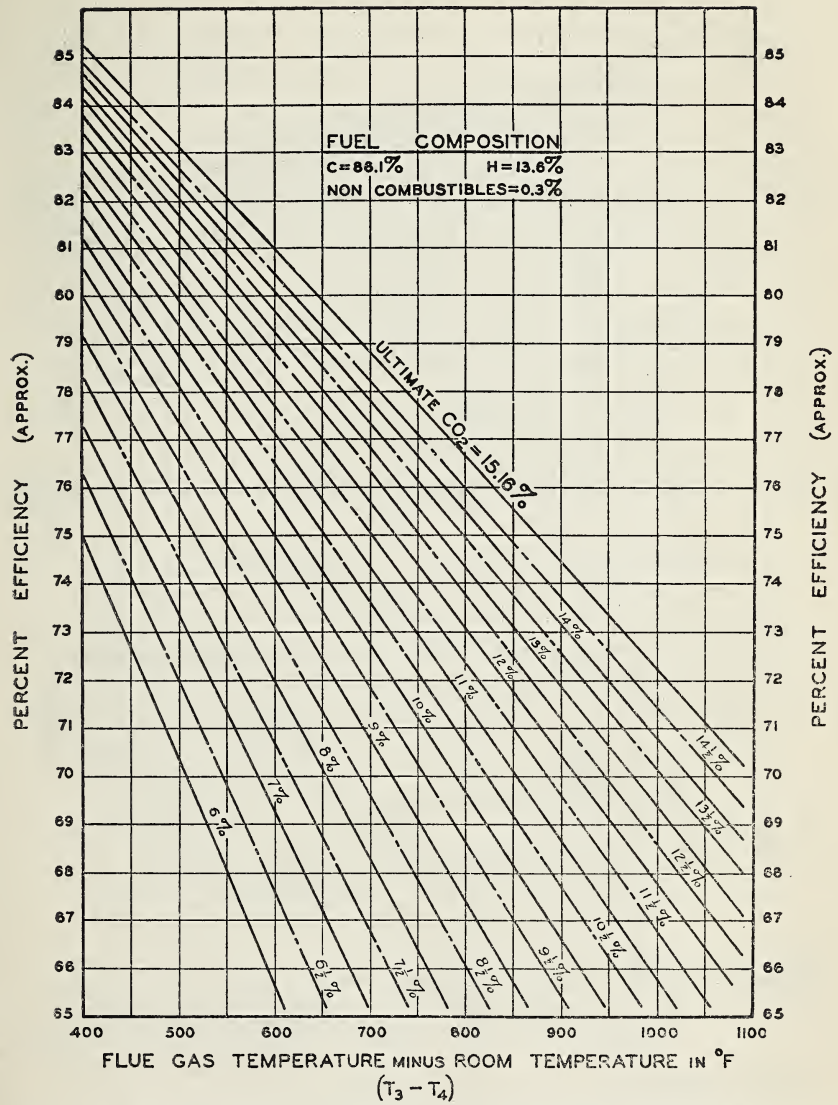


FIGURE 8.—*Enlarged efficiency chart for warm-air furnaces equipped with vaporizing pot-type burners.*

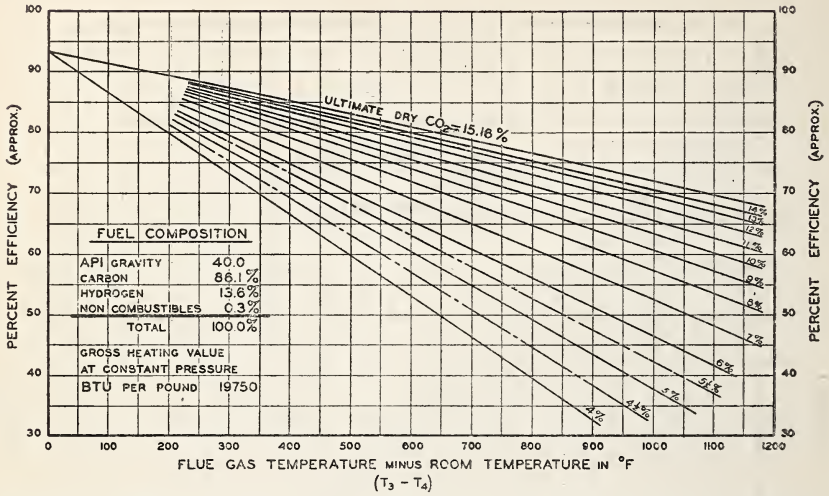


FIGURE 9.—*Efficiency chart for warm-air furnaces equipped with vaporizing pot-type burners.*

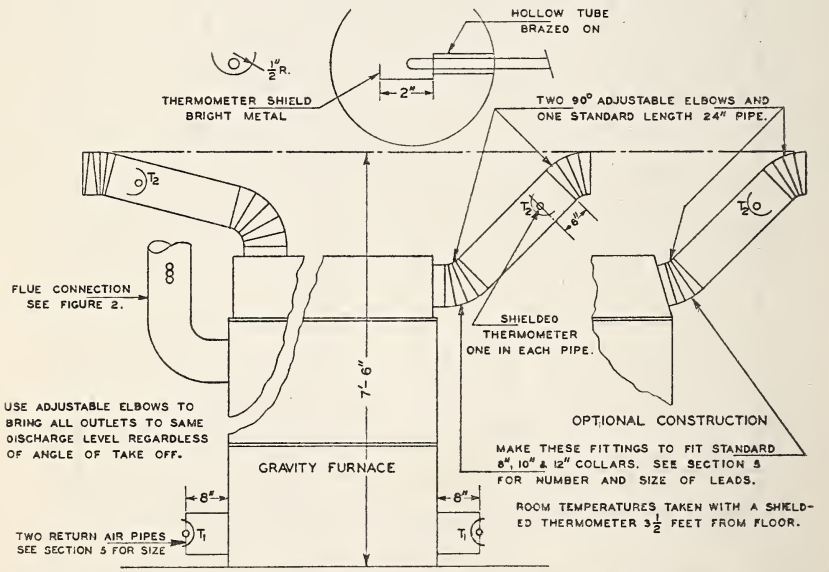


FIGURE 10.—*Gravity-furnace-testing arrangement*

PUBLICATION OF FURNACE RATINGS

6.1 All published furnace ratings shall be determined as outlined in section 4 or 5 and shall be expressed thus:

Gross output _____ Btu/hr at _____ draft with CS _____oil.
and/or
Bonnet capacity _____ Btu/hr at _____ draft with CS _____oil.
Rated cfm output_____ at_____ °F temperature rise at _____in.
static pressure.

INFORMATIVE LABELING

7.1 The following data shall be permanently affixed to each furnace as evidence of compliance with the provisions of this standard. If rated for high altitude, see note under paragraph 4.72.

Model No. _____ CS No. CS(E)104–43.
Bonnet capacity _____ Btu/hr _____.
Gross output _____ Btu/hr _____.
Tested at _____ draft, using CS No. _____ oil.
Manufacturer's name and address _____
The heaviest grade of oil for which furnace is approved under paragraph 1.1.

GUARANTEES

8.1 The following uniform guarantee or warranty shall accompany each furnace or be published in the manufacturer's printed literature or both:

> The _____ Company warrants all oil-burning furnaces manufactured by it and bearing Commercial Standard (Emergency) CS(E)104–43 to be free from defects in material and workmanship. If any part of the equipment herein described and sold by the company proves to be defective in workmanship or material, and if such part is within 12 months from date of shipment from the company's factory returned to such factory, transportation charges prepaid, and if the same is found by the company to be defective in workmanship or material, it will be replaced or repaired, free of charges, f. o. b. factory.
>
> The company assumes no liability for consequential damages of any kind, and the purchaser by acceptance of this equipment will assume all liability for the consequences of its use or misuse by the purchaser, his employee, or others. A defect, in the meaning of this warranty, in any part of said equipment shall not, when such part is capable of being renewed, repaired, or replaced, operate to condemn such equipment. This warranty is expressly in lieu of all other warranties, guarantees, obligations, or liabilities, expressed or implied, by the company or its representatives.

EFFECTIVE DATE

9.1 The standard is effective for new production from January 1, 1943.

STANDING COMMITTEE

The following comprise the membership of the standing committee which is to review, prior to circulation for acceptance, proposed revisions to keep the standard abreast of progress. Each organization nominated its own representative. Comment and questions concerning the standard and suggestions for revision may be addressed to any member of the committee or to the Division of Trade Standards, National Bureau of Standards, which acts as secretary for the committee:

Manufacturers:

D. F. Jones (chairman), Duo-Therm Division, Motor Wheel Corporation, Lansing, Mich.
A. T. Atwill, Quaker Manufacturing Co., 223 West Erie St., Chicago, Ill.
A. P. Livar, Airtemp Division, Chrysler Corporation, Dayton, Ohio.
Stanley Perry, Oil Devices, 341 East Ohio St., Chicago, Ill.
Marc Resek, Perfection Stove Co., 7609 Platt Ave., Cleveland, Ohio.
George Schueder, Evans Products Corporation, Fullerton at Greenfield St., Detroit, Mich.

Distributors:

Ira G. Watson, Marshall-Wells Co., Duluth, Minn.
Gerald C. MacDonald, Ward's Bureau of Standards, Montgomery Ward & Co., 618 West Chicago Avenue, Chicago, Ill.
American Institute of Wholesale Plumbing & Heating Supply Associations, invited to name representative.
S. L. Boyar, Department 642, Sears, Roebuck & Co., 925 South Homan Avenue, Chicago, Ill.
E. L. Pugh, Southern Wholesalers, Inc., 712 Volunteer Bldg., Atlanta, Ga.
H. C. Little, H. C. Little Burner Co., Inc., San Rafael, Calif., Representing Pacific Oil Burner Association.

Consumers:

Thomas Hall Locraft, 1413 H St., N. W., Washington, D. C., Representing American Institute of Architects.
R. K. Thulman, Federal Housing Administration, National Housing Agency, Washington, D. C.
Millard W. Merrill, United States Metals Refining Co., Carteret, N. J., Representing National Association of Purchasing Agents.
Arnold E. Barager, Durable Goods Section, Standards Division, Office of Price Administration, Washington, D. C.
Peter J. Furlong, Public Buildings Administration, Federal Works Agency, Washingon, D. C.
Felix A. Peckham, Construction Division, Corps of Engineers, War Department, Ft. Myer, Va.

Testing Laboratories:

S. Konzo, University of Illinois, Urbana, Ill.
W. T. Miller, Purdue University, Lafayette, Ind.
J. H. Witte, Underwriters' Laboratories, Inc., 207 East Ohio St., Chicago, Ill.
Richard S. Dill, National Bureau of Standards, Washington, D. C.

HISTORY OF PROJECT

On July 14, 1941, an informal meeting of leading manufacturers recorded their desire to establish a test code for warm-air furnaces equipped with vaporizing pot-type oil burners. After a series of meetings for the preparation of a proposed standard, four representative manufacturers on March 18, 1942, requested the cooperation of the National Bureau of Standards in the establishment of a commercial standard, and suggested that the draft as revised on February 12, 1942, be used as a basis for further discussion.

The proposed standard was adjusted and tentatively adopted by a conference of manufacturers on April 17, 1942, in Chicago, Ill., held under the auspices of the National Bureau of Standards. Incomplete parts were supplied by the Technical Committee on June 11, 1942, and a second conference in Chicago on June 24, 1942, reviewed, revised, and adopted a later draft, which, on authority of the conference, was circulated widely for written comment.

Following suitable adjustment in line with the composite written comment, the revised draft was circulated on September 28, 1942, to the entire trade for written acceptance, as it appeared from the comment that a general conference was unnecessary, particularly in view of the wartime emergency. Upon receipt of acceptances in writing from a preponderant majority, announcement was issued on December 9, 1942, that the standard would become effective for new production from January 1, 1943.

ACCEPTANCE OF COMMERCIAL STANDARD

If acceptance has not previously been filed, this sheet properly filled in, signed and returned, will provide for the recording of your organization as an acceptor of this commercial standard.

Date_____

Division of Trade Standards,
National Bureau of Standards,
Washington, D. C.

Gentlemen:

Having considered the statements on the reverse side of this sheet, we accept the Commercial Standard CS(E)104–43 as our standard of practice in the

Production [1] Distribution [1] Use [1] Testing [1]

of warm-air furnaces equipped with vaporizing pot-type oil burners.

We will assist in securing its general recognition and use, and will cooperate with the standing committee to effect revisions of the standard when necessary.

Signature of individual officer_____
(In ink)

(Kindly typewrite or print the following lines)

Name and title of above officer_____

Organization_____
(Fill in exactly as it should be listed)

Street address_____

City and State_____

[1] Please designate which group you represent by drawing lines through the other three. Please file separate acceptances for all subsidiary companies and affiliates which should be listed separately as acceptors. In the case of related interests, trade papers, colleges, etc., desiring to record their general approval, the words "in principle" should be added after the signature.

(Cut on this line)

TO THE ACCEPTOR

The following statements answer the usual questions arising in connection with the acceptance and its significance:

1. *Enforcement.*—Commercial standards are commodity specifications voluntarily established by mutual consent of those concerned. They present a common basis of understanding between the producer, distributor, and consumer and should not be confused with any plan of governmental regulation or control. The United States Department of Commerce has no regulatory power in the enforcement of their provisions, but since they represent the will of the interested groups as a whole, their provisions through usage soon become established as trade customs, and are made effective through incorporation into sales contracts by means of labels, invoices and the like.

2. *The acceptor's responsibility.*—The purpose of commercial standards is to establish for specific commodities, nationally recognized grades or consumer criteria and the benefits therefrom will be measurable in direct proportion to their general recognition and actual use. Instances will occur when it may be necessary to deviate from the standard and the signing of an acceptance does not preclude such departures; however, such signature indicates an intention to follow the commercial standard where practicable, in the production, distribution or consumption of the article in question.

3. *The Department's responsibility.*—The major function performed by the Department of Commerce in the voluntary establishment of commercial standards on a Nation-wide basis is fourfold: first, to act as an unbiased coordinator to bring all interested parties together for the mutually satisfactory adjustment of trade standards; second, to supply such assistance and advice as past experience with similar programs may suggest; third, to canvass and record the extent of acceptance and adherence to the standard on the part of producers, distributors, and users; and fourth, after acceptance, to publish and promulgate the standard for the information and guidance of buyers and sellers of the commodity.

4. *Announcement and promulgation.*—When the standard has been endorsed by a satisfactory majority of production or consumption in the absence of active, valid opposition, the success of the project is announced. If, however, in the opinion of the standing committee or the Department of Commerce, the support of any standard is inadequate, the right is reserved to withhold promulgation and publication.

ACCEPTORS

The organizations and individuals listed below have accepted this commercial standard (emergency) as their standard of practice in the production, distribution, use, and testing of warm-air furnaces equipped with vaporizing pot-type oil burners. Such endorsement does not signify that they may not find it necessary to deviate from the standard, nor that producers so listed guarantee all of their products in this field to conform with the requirements of this standard. Therefore, specific evidence of conformity should be obtained where required.

ASSOCIATIONS

American Institute of Architects, The, New York, N. Y.
American Specification Institute, Chicago, Ill.
Fuel Oil Distributors Association of New Jersey, Newark, N. J.
National Association of Purchasing Agents, New York, N. Y.
National Council of Women of the United States, New York, N. Y. (In Principle.)
Saginaw Association of Master Plumbers, Saginaw, Mich.
Steam Heating Equipment Manufacturers Association, New York, N. Y. (In Principle.)
Stove Mounters International Union of N. A., St. Louis, Mo. (In Principle.)

FIRMS

Abbott Engineering Co., Newark, N. J.
Adams, Franklin O., Tampa, Fla.
Aegee Supply Co., Inc., Rochester, N. Y.
American Mutual Alliance, Chicago, Ill.
American Radiator & Standard Sanitary Corporation, Pittsburgh, Pa.
American Stove Co., Lorain Division, Lorain, Ohio.
Andrews, Jones, Biscoe & Whitmore, Boston, Mass.
Arrow Petroleum Co., Forest Park, Ill. (In Principle.)
Auler, Jensen & Brown, Oshkosh, Wis.
Austin, Ennis R., South Bend, Ind.
Automatic Equipment Co., Lexington, Ky.
Automatic Heat, Inc., Philadelphia, Pa.
Automatic Products Co., Milwaukee, Wis.
Baltimore, Bureau of Plans & Surveys of, Baltimore, Md.
Barton Mansfield Co., Jonesboro, Ark.
Bennett Oil Co., Omaha, Nebr.
Berger, F. E., & R. L. Kelley, Champaign, Ill.
Better Living Co., Jackson, Miss.
Beuttler, William, Sioux City, Iowa.
Bial, George F., Hasbrouck Heights, N. J.
Blithe, Wesley Lesher, Philadelphia, Pa.
Boehm, George A., New York, N. Y.
Borg-Warner Corporation, Norge Heating & Conditioning Division, Detroit, Mich.
Bovard, William R., Kansas City, Mo. (In Principle.)
Braseth & Houkom, Fargo, N. Dak.
Braun Bros. Heating Supply Co., Winnetka, Ill.
Brazer, Clarence W., New York, N. Y.
Brust & Brust, Milwaukee, Wis.
Bucky, Fred W., Jr., Jacksonville, Fla.
Burns Supply Co., Long Island City, N. Y.
Bursaw Oil Corporation, Salem, Mass.
C., B. & Q. R. R. Co., Chicago, Ill.
C & M Construction Co., Inc., Philadelphia, Pa.
Cagney Co., J. R., Chicago, Ill.
Cannon & Mullen, Salt Lake City, Utah.
Central Co-operative Wholesale, Superior, Wis.
Chapin, Rollin C., Minneapolis, Minn. (In Principle.)
Chrysler Corporation, Airtemp Division, Dayton, Ohio.
Cincinnati, City of, Dept. of Purchasing, Cincinnati, Ohio.
Cleveland, City of, Division of Buildings, Cleveland, Ohio.
Conkey & Co., H. D., Field Control Division, Mendota, Ill. (In Principle.)
Conrad & Cummings, Binghamton, N. Y.
Conrow, H. S., Wichita, Kans.
Consumers Heating Equipment Co., Inc., Baltimore, Md.
Cooper, David M., Ambridge, Pa.
Cooper, Inc., R., Jr. (Air Conditioning Corporation), Chicago, Ill.
Corriveaux, F.,—Home & Industrial Service, Schenectady, N. Y.
County Seat Plumbing Supply Co., Inc., White Plains, N. Y.
Crowell & Lancaster, Bangor, Maine.
Curtsinger, L. P., Eugene, Oreg.

Dallman Supply Co., Sacramento, Calif.
DeJarnette, Charles Wagner, Des Moines, Iowa.
Dexter & Blethen, Dover-Foxcroft, Maine.
Dodge Corporation, F. W., Sweet's Catalog Division, Chicago, Ill.
Dome Oil Co., Inc., Washington, D. C.
Donovan, John J., Berkeley, Calif.
Dubin & Co., Inc., Hartford, Conn.
Dudley, James G., Brooklyn, N. Y.
East Orange Fire Department, East Orange, N. J.
Eldridge, Charles Wm., Oswego, N. Y.
Elliott-Lewis Co., Philadelphia, Pa.
English, Harold T., Hutchinson, Kans.
Erdelen, Arthur F., St. Louis, Mo. (In Principle.)
Estate Stove Co., The, Hamilton, Ohio.
Evans Products Co., Detroit, Mich.
Fisher Electrical Service, Union, Union Co., N. J.
Fitz-Gibbon, T. David, Norfolk, Va. (In Principle.)
Flannagan, Eric G., Henderson, N. C.
Furnace Dealers, Inc., Milwaukee, Wis.
Furnace & Sheet Metal Works, Minneapolis, Minn.
Gasoroil Manufacturing Corporation, Genoa City, Wis.
Gall, Harry L. C., New York, N. Y.
Gibbs Oil Co., Miami, Fla. (In Principle.)
Hahn, Stanley W., Silver Spring, Md.
Haldeman, Inc., Harry F., Los Angeles, Calif.
Harper & West, Boston, Mass.
Harris, Jay, Bronx, New York, N. Y.
Harrison & Rouse Fuel Co., Baltimore, Md.
Hartley & Son, Elwood, Ind.
Harvard University, Cambridge, Mass.
Hasness, Carlisle D., Harrisburg, Pa.
Haxby & Bissell, Minneapolis, Minn.
Heating Service Co., Winnetka, Ill.
Heating Supply Co., Inc., Rochester, N. Y.
Heil Co., The, Milwaukee, Wis.
Helfensteller Hirsch & Watson, St. Louis, Mo.
Herlan—Patterson, Inc., Buffalo, N. Y.
Hodgdon & Son, Charles, Chicago, Ill.
Holland Furnace Co., Holland, Mich.
Holsman & Holsman, Chicago, Ill.
Home Comfortable, Inc., The, Louisville, Ky.
Hope, Frank L., Jr., San Diego, Calif.
Hopkins, Albert Hart, Buffalo, N. Y.
Illinois Farm Supply Co., Chicago, Ill. (In Principle.)
Illinois, University of, Department of Architecture, Urbana, Ill. (In Principle.)
International Heater Co., Utica, N. Y.
International Oil Burner Co., Inc., St. Louis, Mo.
Jacobs, Lionel L., Wayne, Pa. (In Principle.)
James & Roach, Detroit, Mich.
Johnson Co., J. D., Pensacola, Fla.
Kahn Associated Architects & Engineers, Inc., Albert, Detroit, Mich.
Kantor Brothers, Inc., Newark, N. J.
Kilham, Hopkins & Greeley, Boston, Mass. (In Principle.)
Koeppen—Baldwin, Denison, Tex.
Kohn, Robert D.,-Chas. Butler, New York, N. Y.
Krauser-Boyd, Inc., North Tonawanda, N. Y.
Kres-Kno Oil Burner Manufacturing Co., New York, N. Y.
Kruckemeyer & Strong, Cincinnati, Ohio.
Kunkel, J. E., Philadelphia, Pa.
Kyle, Herbert L., Charleston, W. Va. (In Principle.)
Latenser & Sons, Inc., John, Omaha, Nebr.
Larrick, Thomas, Athens, Ohio.
Law, Law & Potter, Madison, Wis.
Leidy Electric Co., Phillipsburg, N. J.
Levy, Will, St. Louis, Mo.
Little Burner Co., Inc., H. C., San Rafael, Calif.
Loeb, Laurence M., White Plains, N. Y.
Lonergan Manufacturing Co., Albion, Mich.
Martino, A. R., Waterbury, Conn.
Mason & Co., George D., Detroit, Mich.
Mason & Co., Inc., W. C., Hartford, Conn.
Massachusetts, Commonwealth of, Metropolitan District Commission, Boston, Mass.
Mansfield & Co., Norfolk, Va.
Massena & du Pont, Wilmington, Del.
Matthews Engineering Co., Dallas, Tex.
Mauran, Russell, Crowell & Mullgardt, St. Louis, Mo.
McMahill Heating Service, Omaha, Nebr.
Midland Cooperative Wholesale, Minneapolis, Minn.
Miller & Yeager, Terre Haute, Ind.
Mitchell Sales Corporation, Bremerton, Wash.
Montgomery Ward & Co., Chicago, Ill.
Moore, David H., Atlantic City, N. J.
Moore & Co., A. B., Daytona Beach, Fla.
Mooser, William, San Francisco, Calif.
Morri Music Shop, Portsmouth, Va.
Motor Wheel Corporation, Duo-Therm Division, Lansing, Mich.

Mueller, F. G., & W. R. Hair, Hamilton, Ohio.
Mundie, Jensen, Bourke & Havens, Chicago, Ill.
Nelson, Albert L., St. Louis, Mo.
New Orleans, Inc., Better Business Bureau of, New Orleans, La. (In Principle.)
New York State Reconstruction Home, West Haverstraw, N. Y.
New York Testing Laboratories, Inc., New York, N. Y.
North Carolina, State of, Division of Purchase & Contract, Raleigh, N. C.
Northern Air Conditioning Corporation, Newark, N. J.
Northern Controlled Heat Co., Inc., Watertown, N. Y.
Officer, Gwynn, Berkeley, Calif.
Oil Burning Engineers, Inc., Chicago, Ill.
Oil Devices, Chicago, Ill.
Oil Heating Equipment Co., Tacoma, Wash.
Orange Memorial Hospital, Orange, N. J. (In Principle.)
Orth, H. W., St. Paul, Minn. (In Principle.)
Overstreet, N. W., Jackson, Miss.
PHC Housing Corporation, New York, N. Y.
Pacific Coast Coal Co., Portland, Oreg.
Parkside Sheet Metal Works, Inc., Chicago, Ill.
Pehrson, G. A., Spokane, Wash.
Pepper, George W., Jr., Philadelphia, Pa.
Perfect Air Conditioning Co., Washington, D. C.
Perfection Stove Co., Cleveland, Ohio.
Perfex Corporation, Milwaukee, Wis. (In Principle.)
Perry-Mann Electric Co., Inc., Columbia, S. C.
Pines Engineering Co., Dallas, Tex.
Platt & Bro., F. P., New York, N. Y. (In Principle.)
Poad Sheet Metal & Furnace Co., Cleveland, Ohio.
Premier Furnace Co., Dowagiac, Mich.
Prentiss Wabers Products Co., Wisconsin Rapids, Wis.
Quaker Manufacturing Co., Chicago, Ill.
Quincy Oil Co., The, Quincy, Mass.
Rearick Bros. Automatic Heating, Gary, Ind.
Reid, William H., Jr., Billings, Mont.
Richards Manufacturing Co., Grand Rapids, Mich.
Rindge & Rindge, Grand Rapids, Mich.
Sacramento, The Better Business Bureau of, Sacramento, Calif. (In Principle.)
St. John's Hospital, Brooklyn, N. Y.
Sawyer Heating Co., Detroit, Mich.
Schneider Hahn Co., A. A., Des Moines, Iowa.
Schoeppe, Edward, Philadelphia, Pa.
Sears, Roebuck & Co., Chicago, Ill.
Servus Oil & Supply Co., Chicago, Ill.
Sidles Co., Omaha, Nebr.
Silent Sioux Oil Burner Corporation, Orange City, Iowa.
Sinclair Refining Co., Chicago, Ill. (In Principle.)
Smith, Frederick L., Jr., Valley Stream, N. Y.
Southeastern Air Conditioning Co., Jacksonville, Fla.
Southwest Heating & Cooling Co., Wichita, Kans.
Sprinchorn & Co., Jamestown, N. Y.
Standard Oil Co. of California, San Francisco, Calif.
Standard Oil Company of New Jersey, New York, N. Y. (In Principle.)
Standard Utilities Corporation, Newark, N. J. (In Principle.)
State Distributing Co., Grand Rapids, Mich.
Staub & Rather, Houston, Tex.
Stoetzel, Ralph E., Chicago, Ill.
Sunland Refining Corporation, Fresno, Calif.
Susquehanna Supply Co., Williamsport, Pa.
Swarthmore Heating Service, Swarthmore, Pa.
Taylor, Ellery K., Haddonfield, N. J.
Tharp & Son, Chas. E., Fort Wayne, Ind.
Thorne, Henry Calder, Ithaca, N. Y.
Underwriters' Laboratories, Inc., Chicago, Ill. (In Principle.)
United States Testing Co., Inc., Hoboken, N. J.
University Heating Co., Inc., Rochester, N. Y.
Utica Radiator Corporation, Utica, N. Y.
Viking Manufacturing Corp., Dayton, Ohio.
Virginia Polytechnic Institute, Blacksburg, Va.
Walsh, Office of William Henry, Chicago, Ill. (In Principle.)
Waltham, City of, Waltham, Mass.
Wampler Co., H. F., Philadelphia, Pa.
Weaver, Rudolph, Gainesville, Fla.
White Rodgers Electric Co., St. Louis, Mo.
Willatsen, Andrew, Seattle, Wash.
Wischmeyer, William F., St. Louis, Mo.
Wright & Wright, Detroit, Mich.
Zimmerman, A. C., Pasadena, Calif.

U. S. GOVERNMENT

Agriculture, U. S. Department of, Washington, D. C.
Federal Public Housing Authority, Washington, D. C.
War Department, Washington, D. C.

COMMERCIAL STANDARDS

CS No. Item

0–40. Commercial standards and their value to business (third edition).
1–42. Clinical thermometers (third edition).
2–30. Mopsticks.
3–40. Stoddard solvent (third edition).
4–29. Staple porcelain (all-clay) plumbing fixtures.
5–40. Pipe nipples; brass, copper, steel, and wrought iron.
6–31. Wrought-iron pipe nipples (second edition). Superseded by CS5–40.
7–29. Standard weight malleable iron or steel screwed unions.
8–41. Gage blanks (third edition).
9–33. Builders' template hardware (second edition).
10–29. Brass pipe nipples. Superseded by CS5–40.
11–41. Moisture regains of cotton yarns (second edition).
12–40. Fuel oils (fifth edition).
13–42. Dress patterns (third edition).
14–39. Boys' button-on waists, shirts, junior and polo shirts (made from woven fabrics) (second edition).
15–29. Men's pajamas.
16–29. Wall paper.
17–42. Diamond core drill fittings (third edition).
18–29. Hickory golf shafts.
19–32. Foundry patterns of wood (second edition).
20–42. Staple vitreous china plumbing fixtures (third edition).
21–39. Interchangeable ground-glass joints, stopcocks, and stoppers (fourth edition).
22–40. Builders' hardware (nontemplate) (second edition).
23–30. Feldspar.
24–43. Screw threads and tap-drill sizes.
25–30. Special screw threads. Superseded by CS24–43.
26–30. Aromatic red cedar closet lining.
27–36. Mirrors (second edition).
28–32. Cotton fabric tents, tarpaulins, and covers.
29–31. Staple seats for water-closet bowls.
30–31. Colors for sanitary ware.
31–38. Wood shingles (fourth edition).
32–31. Cotton cloth for rubber and pyroxylin coating.
33–32. Knit underwear (exclusive of rayon).
34–31. Bag, case, and strap leather.
35–42. Plywood (hardwood and eastern red cedar) (second edition).
36–33. Fourdrinier wire cloth (second edition).
37–31. Steel bone plates and screws.
38–32. Hospital rubber sheeting.
39–37. Wool and part wool blankets (second edition) (withdrawn as commercial standard, July 14, 1941).
40–32. Surgeons' rubber gloves.
41–32. Surgeons' latex gloves.
42–35. Fiber insulating board (second edition).
43–32. Grading of sulphonated oils.
44–32. Apple wraps.
45–42. Douglas fir plywood (fifth edition).
46–40. Hosiery lengths and sizes (third edition).
47–34. Marking of gold-filled and rolled-gold-plate articles other than watchcases.
48–40. Domestic burners for Pennsylvania anthracite (underfeed type) (second edition).
49–34. Chip board, laminated chip board, and miscellaneous boards for bookbinding purposes.
50–34. Binders board for bookbinding and other purposes.
51–35. Marking articles made of silver in combination with gold.
52–35. Mohair pile fabrics (100-percent mohair plain velvet, 100-percent mohair plain frieze, and 50-percent mohair plain frieze).
53–35. Colors and finishes for cast stone.
54–35. Mattresses for hospitals.
55–35. Mattresses for institutions.
56–41. Oak flooring (second edition).
57–40. Book cloths, buckrams, and impregnated fabrics for bookbinding purposes except library bindings (second edition).

CS No. Item

58–36. Woven elastic fabrics for use in overalls (overall elastic webbing).
59–41. Woven textile fabrics—testing and reporting (third edition).
60–36. Hardwood dimension lumber.
61–37. Wood-slat venetian blinds.
62–38. Colors for kitchen accessories.
63–38. Colors for bathroom accessories.
64–37. Walnut veneers.
65–43. Methods of analysis and of reporting fiber composition of textile products (second edition).
66–38. Marking of articles made wholly or in part of platinum.
67–38. Marking articles made of karat gold.
68–38. Liquid hypochlorite disinfectant, deodorant, and germicide.
69–38. Pine oil disinfectant.
70–41. Phenolic disinfectant (emulsifying type) (second edition) (published with CS71–41).
71–41. Phenolic disinfectant (soluble type) (second edition) (published with CS70–41).
72–38. Household insecticide (liquid spray type).
73–38. Old growth Douglas fir standard stock doors.
74–39. Solid hardwood wall paneling.
75–42. Automatic mechanical draft oil burners designed for domestic installations (second edition).
76–39. Hardwood interior trim and molding.
77–40. Sanitary cast-iron enameled ware.
78–40. Ground-and-polished lenses for sun glasses (second edition) (published with CS79–40).
79–40. Blown, drawn, and dropped lenses for sun glasses (second edition) (published with CS78–40).
80–41. Electric direction signal systems other than semaphore type for commercial and other vehicles subject to special motor vehicle laws (after market).
81–41. Adverse-weather lamps for vehicles (after market).
82–41. Inner-controlled spotlamps for vehicles (after market).
83–41. Clearance, marker, and identification lamps for vehicles (after market).
84–41. Electric tail lamps for vehicles (after market).
85–41. Electric license-plate lamps for vehicles (after market).
86–41. Electric stop lamps for vehicles (after market).
87–41. Red electric warning lanterns.
88–41. Liquid-burning flares.
89–40. Hardwood stair treads and risers.
90– . (Reserved for power shovels and cranes.)
91–41. Factory fitted Douglas fir entrance doors.
92–41. Cedar, cypress and redwood tank stock lumber.
93–41. Portable electric drills (exclusive of high frequency).
94–41. Calking lead.
95–41. Lead pipe.
96–41. Lead traps and bends.
97–42. Electric supplementary driving and passing lamps for vehicles (after market).
98–42. Artists' oil paints.
99–42. Gas floor furnaces—gravity circulating type.
100–42. Multiple-coated, porcelain-enameled steel utensils.
101–43. Flue-connected oil-burning space heaters equipped with vaporizing pot-type burners.
102– . (Reserved for Diesel and fuel-oil engines).
103–42. Cotton and rayon velour (jacquard and plain).
(E)104–43. Warm air furnaces equipped with vaporizing pot-type oil burners.
105–43. Mineral wool; loose, granulated, or felted form, in low-temperature installations.
(E)106–43. Boys' pajamas (made from woven fabrics).
(E)107–43. Commercial electric refrigeration condensing units.

NOTICE.—Those interested in commercial standards with a view toward accepting them as a basis of everyday practice may secure copies of the above standards, while the supply lasts, by addressing the Division of Trade Standards, National Bureau of Standards, Washington, D. C.